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ABSTRACT

In this study the use of puzzles, games, and other instructional adjuncts was explored as part of a statewide evaluation of the California Early Childhood Education Program. Based on geographic, bilingual, and minimum school size criteria, 72 schools were selected for intensive study. Two second and two third grade classrooms were chosen at random from each school. Data were collected by using both naturalistic and structured procedures, including classroom observation, questionnaires, interviews, and achievement measures. Means and standard deviations for proportions of classrooms in which materials were observed in use during reading and mathematics are given as well as the proportion of children who report that they play games after they complete assigned work. Results of regression analyses suggest negative relationships among the use of instructional adjuncts and student performance in reading and mathematics. The negative relationship was especially pronounced among second grade children. A positive relationship between teachers' reports about the availability of materials and student performance was found. Among the conclusions, it is indicated that the motivational value of instructional adjuncts was slight. There was no evidence that the materials were used on a contingency basis. Instructional adjuncts provide a cosmetic method for quickly achieving the appearance of individualization. (Author/RH)

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FUN AND GAMES: THEIR RELATIONSHIP TO BASIC SKILLS IN ELEMENTARY SCHOOL CHILDREN

It is common to judge the excellence of school offerings partly by inspecting the diversity of educational opportunities available to children. For example, school buildings deployed in pods, with open space and acrylic carpeting convey the impression that the school, and its purposes, are modern and up-to-date.

Similarly, classrooms which provide a number of options for presenting instruction also arouse feelings of satisfaction. The etiology of these judgments derives partly from analyses of innovation and change. Pincus (1975) describes organizational requirements for educational institutions. One prominent need is to maintain the appearance of progressive management, a concern met by outfitting educational institutions with the latest in instructional technology, quite apart from the actual effects the technology may produce in learners. Yet, another source for our belief that instructional options are beneficial evolves from the literature of individual differences. Variables labeled as aptitudes or cognitive styles have been identified (Bracht 1974, Cronbach and Snow 1977). The ideal instructional offerings would allow matches between learner characteristics and various instructional options, with the assumption of increased productivity for all.

Among the popular instructional options available are those which are packaged adjuncts to regular, teacher-mediated instruction. The role of these products. such as learning games, puzzles and audio-visual

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supplements, is yet to be clear. Educators assume that because many of these activities are cast in the form of play, they contribute not only to skill development but to affective consequences as well. Such assumptions would seem to be dependent upon a given set of premises: 1) that the adjuncts have incentive value for the learner; 2) that the practice they provide is pertinent to particular goals; 3) that the adjuncts themselves have demonstrated effectiveness and do not have distracting elements.

Writers who support the use of adjuncts as incentives have suggested that games and puzzles may capitalize on children's natural curiosity and thus sustain activity beyond that which might be ordinarily imagined (Bruner 1966). Similarly audio-visual stimuli, ranging from film, audio-tape and self administered cassette slide-tape, also seem to offer the opportunity to introduce variety into the learning situation in an effort to achieve both cognitive and affective goals. Little is presently known about the incentive value of such adjuncts. The recent summary of research by Condry (1977) focuses on incentives in the learning situation, with generally negative conclusions (although the mean quality of incentives used, e.g., an offer to tour the Psychology Department of a university brings into question why incentives do as well as they do). Condry's work is especially valuable in that it clarifies the enormously weak base of research in the field, where generalizations flow from one instructor - fifty subjects research paradigms. Further, the issue of the integration of the incentive, e.g., game, as an instrument of learning is not clearly analyzed. Thus, the

empirical value of games and puzzles as learning incentives has not as yet been established.

A second issue in the analysis of instructional options is whether their use is pertinent to particular, desired outcomes. For example, a teacher who plays Captain Kirk to a child's Mr. Spock may be engaging in idle Star Trek behavior. However, if his purpose is to elicit verbal statements from a learner who has difficulty in self-expression, then the "play" may be desirable. This instance is only a particular from the more general problem of determining from observation alone the utility of given instructional acts. Children may be observed to be listening intently with earphones to audio material which in fact, is being played at the wrong speed.

Questions may be raised regarding how teachers see the use of games, puzzles and other adjuncts in their classrooms. Are they used to provide a congenial vehicle for rehearsal of learned skills? Is their employment a planned part of an instructional design? Are they available at the learners' option to select, either as a form of practice, an exploration of a new skill, or as an incentive? Very little evidence is available bearing on these concerns.

Our third question is what is the demonstrated effectiveness of instructional adjuncts under the best of circumstances? Clearly, the evaluation of all forms of instructional adjuncts is a critical matter of long standing. In their classic studies on mass communication, Hovland, Lumsdaine and Sheffield, (1949) pointed out that the effectiveness of instructional adjuncts require careful evaluation, in the particular

setting intended for their use. They specifically proscribed generalizations of utility about a class of innovations, e.g., film versus television, principally because of the futility of a representative sample of the compared media classes. Such a warning was almost completely overlooked in the rash of studies which followed bent upon comparing the effects of programmed instruction, "Keller approaches," or film with traditional instruction. The concern for limiting generalizations regarding the effectivenesses of media and other instructional formats was advanced more recently by Lumsdaine (1963) and by Lieffer (1977) perhaps, in time, with more effect.

If experimental methods are inadmissible because of proper restrictions on generalization, at least the specific evaluation of the effects of instructional adjuncts would seem to be possible. Indeed, the movement labeled "learning verification and revision (LVR)" promoted by Komoski (1975) suggest that instructional options be subjected to some minimal form of empirical demonstration so that consumers of educational products would be able to make decisions based on reported tryouts of the materials. With the exception of large-scale, federally supported development efforts, this requirement for data collection and empirical demonstration has rarely been fulfilled. The situation appears relatively static because neither consumers nor authorities in educational bureaucracies are inclined to demand the objective evaluation of instructional artifacts. Producers plead that such evaluation is not feasible because of cost prohibitions and the difficulty in fairly representing the variety of conditions under which such adjuncts might be

conceivably employed.

Yet, our belief in instructional options persists, and their use is widespread.

In this study, the use of puzzles, games, and other instructional adjuncts was explored as part of the specific evaluation of a broad level educational program. In conducting a statewide evaluation of the California Early Childhood Education (ECE) Program (Baker, 1976; 1977) an opportunity was presented to investigate classroom instructional practices. Focusing such an exploration on the use of instructional options seemed especially appropriate in the ECE case because the program makes explicit reference to students' attitudinal as well as cognitive development. The program is also required by its enabling legislation to provide "individualized learning experiences" for children in kindergarten through third grade. In this research, an attempt was made to assess the relationships among the use of instructional adjuncts and cognitive and affective behavior.

Subjects and Sampling

ECE is administered on a school to school basis, thus the unit of sampling originally was the school. Based on geographic, bilingual, and minimum school size criteria, 250 schools were selected from the total state population. These schools represented different ECE status (from 0-3 years of funding) and different categories with respect to the receipt of compensatory education funds from federal and/or state sources. From within these 250 schools, 72 schools were selected for

intensive study. Two second and two third grade classrooms were chosen at random from each of the 72 schools for data collection.

Dependent Measures

Student performance in mathematics and reading was assessed by a variety of instruments: Reading performance was measured using specially developed written criterion-referenced tests with subscales related to the child's ability: a) to discriminate regularly spelled words when presented with an oral stimulus; b) to discriminate vocabulary (irregularly spelled) words when presented with an oral stimulus; c) to demonstrate comprehension of information by answering "who, what, and when" type questions when presented with short fiction and non-fiction paragraphs. Mathematics performance was assessed by written tests with scales assessing: a) ability to perform simple arithmetic operations; b) to translate word problems into number sentences; c) to select the correct combination of printed coins in "making change" money problems. Reading ability was further estimated by selecting between eight and twelve children from each of the classrooms and asking them individually to read aloud sentences drawn at random from the four most popular state text adoptions in reading. Responses were scored for mispronunciation, substitution and omission errors. Affective responses were assessed by using a modified version of the School Sentiment Index (1972) and emphasizing the enjoyment of school, attitude versus subject matter and attitude toward self subscales. These subscales were selected as those most likely to be sensitive to program

effects. (Complete descriptions of technical properties of measures are available in Volume IV of the Evaluation of the Early Childhood Program, Baker et al, 1977).

Procedure

Data were collected by using a mixture of naturalistic and structured procedures. Classrooms in second and third grades were observed twice, for twenty minutes each, once during the reading period and once during mathematics instruction. The observer recorded the kinds of materials or adjunct instructional products actually in use by one or more children. Teachers were asked on questionnaries and in interviews about the availability of materials. Three children were selected from each classroom and interviewed with respect to the kinds of activities they engaged in, what they were likely to do when they finished an assigned task and what they liked to do best. Achievement measures relating to reading and mathematics skills were administered by the regular classroom teacher, with the exception of the oral reading test which was individually administered by research project staff. The affective instrument, with a Spanish translation where necessary, was administered on a group basis to children when the teacher was out of the classroom, in order to heighten the children's propensity to be candid. Responses on the affective instrument were made anonymously and are summarized only at the classroom level.

Data Analysis

Constructed responses for interview and individual oral reading data were coded, cross-checked and then submitted to multiple regression analyses.

Means and standard deviations are presented in Tables 1 and 2 for the proportion of classrooms in which the actual use of puzzles, games audio visual activities or "other" activities was observed. "Other" represented a classification used for novel or unusual materials which involved neither standard nor supplementary reading and mathematics activities.

(Insert Tables 1 and 2 about here)

The relatively high incidence of observed use of such adjuncts is corroborated by our interview data, derived from structured conversations with second and third grade children. Children were asked what they did when they completed the work the teacher had assigned. The mean proportion of responses are presented in Table 3.

(Insert Table 3 about here)

Children were also asked to report whether they worked alone, in small groups or in large groups, and over sixty percent ($\bar{X}$ = .62, s.d., .20) reported they most often worked by themselves, a fact which suggests that the games may not be the occasion for socialization activity.

Teachers were asked on a questionnaire how they would allocate $2500 for use in their classrooms. Results are presented in Table 4.

(Insert Table 4 about here)

Regression analyses conducted on these data entered independent variables, e.g., observation, interview results and dependent measures.

(Insert Tables 5 and 6 about here)

The data in Tables 5 and 6 clearly suggest negative relationships among the use of instructional adjuncts and student performance reading and mathematics. Such relationships are attentuated in the third grade where two of the findings do not reach statistical significance. However, second grade children appear to be particularly susceptible to this relationship. This may be a function of maturation or range restriction, where third grade children were performing at high levels on our criterion measures.

Our findings are elaborated by the responses of teachers to a questionnaire item regarding the variety of materials they had available in reading. Data are reported in Table 7 below.

(Insert Table 7 about here)

The positive relationship between teachers' reports about the availability of materials and student performance must be considered against the contradicting results from observations. It is likely that teachers who regard themselves as well taken care of by the school, e.g., enough materials, may be more satisfied individuals.

The actual variety of materials available to any given respondent may have been large or small. Thus, a teacher who needs a great number of alternatives might feel undersupplied with six or seven options while a teacher who prefers a single approach might be well satisfied with three or four alternatives.

Discussion

From our findings we can conclude the following:

1. Puzzles, games and audio-visual activity are in use in a significant proportion of elementary school classrooms. Since our sample included both funded, e.g., Title I, and non-funded classrooms, no attribution of their use should be made by program status; in fact, no significant differences were found.

2. A substantial proportion of teachers would spend funds on the purchase of such materials if offered a chance.

3. Teachers who report the availability of a large number of instructional options have classes which perform generally well.

4. The observed use of puzzles, games and, to a lesser extent, audio-visual devices is negatively related to pupil performance. This relationship is more pronounced for second grade children.

In the light of our original speculations regarding the use of instructional adjuncts, this broadly based study provides an interesting platform for discussion. How are adjuncts being used? Because of the correlational design of this research, no causal statements are appropriate; however, by investigating the patterns of findings, certain directional inferences may be posited. With regard to the incentive function of games, what are our findings? First, in our study, no significant relationship was found for the use of instructional options and children's attitude, a fact which suggests that any potential incentive relationship is not dramatically strong. Adjuncts might possess some incentive properties, but perhaps of a distracting rather than facilitating quality. In fact, the pronounced negative relationships found for younger children might be associated with their relative ease of distraction. In every case, instructional adjuncts were in use concurrently with other, more traditional activities. Perhaps the adjuncts were attractive enough to divert attention from a relatively routine learning task, but not sufficiently strong in their desirability to encourage children to attend to regular tasks so that they might "play" later. Further, there is no evidence that these adjuncts were used on a contingency basis; rather, use of adjuncts seemed to be a function of "finishing" an assigned task. Completion, rather than

the quality of the child's effort, might be rewarded. Thus, such options might serve to encourage children to "skim" through their work in order to complete their assignment quickly.

The relationship of teacher reports of instructional options and performance was clear. Perhaps adjuncts make their contribution to children's affective development by helping teachers to be happy, a mediating and important variable for children's learning. More likely, teachers who are already satisfied with their roles also have no complaints about the materials provided them.

The negative relationship of use of adjuncts and student learning may be interpreted in other ways. One possibility is adjuncts are not being used which are directly pertinent to the skills of reading and mathematics as assessed. Although our tests were based on objectives regarded as important and common to children in primary education, it is possible that the most popular products were directed toward other goals. Another, more plausible hypothesis is that the instructional options used were probably neither appropriate to goals nor effective instructional devices in themselves. The cost of developing and testing effective instructional products is considerable and there is little reason to believe that producers of such materials would undertake costly efforts when less expensive ones presently serve. Thus, poor results might be caused simply by ineffective materials.

An alternative reason for the negative association may reside in the contradictory learning methods which may be emboddied in instructional products when compared with regular classroom teaching. For instance,

a game may encourage children to use a given rule for "winning" whereas the teacher may employ a disparate approach. And there may be conflicts within the adjuncts themselves. Primary age children may become confused if they are presented with incompatible stragegies for problem solving, for example, a phonetic games used with look-see reading program.

In addition, one might offer a hypothesis about the selection of children who "get" to use such adjuncts. It is possible that children who have the most interaction with games and audio-visual activities are precisely those with whom the teacher has the most instructional difficulty. The teacher may place these children in one-to-one contact with instructional products in order to avoid frustrating interaction with a difficult learner. A more benign interpretation is that teachers may use the games to brighten up a generally difficult learning experience for a low achieving child. Thus, the game or audio-visual device is used as a relief period for the child from the onerous and unrewarding role of trying to learn and failing.

Thus, it should not be inferred directly from this study that puzzles, games and other classroom novelties are unalterably nefarious. What should be clear, however, is that present educational trends will continue to encourage the use of individualized approaches to learning. Instructional adjuncts provide a cosmetic method for quickly achieving the appearance of individualization, for children are required to interact individually or in small groups with such materials. If we can expect educational practice to continue to embrace the idea of matching learning opportunities with skills and needs of learners, a deeper level of in-

structional analysis will be required to help teachers move beyond the illusion of individualized instruction to its reality. Clearly, if such adjuncts could be marketed without the usual caveat emptor we have come to expect, the problem would be on its way to solution. Short of such a revolution, we should begin to expect teachers to analyze the materials made available to them in terms of their likelihood to assist in instructional outcomes.

Thus, the teacher must begin to learn how to select educational materials for matched not only to a learners' age group but to a learners' individual needs for skill development. Teachers might also begin to differentiate adjuncts whose major purpose is to provide enjoyment in the school day, and thus might have simple incentive characteristics from those which may serve as a means for meeting desired cognitive outcomes.

TABLE 1

MEANS AND STANDARD DEVIATIONS FOR PROPORTIONS OF CLASSROOMS IN WHICH MATERIALS WERE OBSERVED IN USE DURING READING

	Mean	Standard Deviation
Puzzles and games	.37	.29
Audio Visual	.27	.27
"Other"	.06	.12

TABLE 2

MEANS AND STANDARD DEVIATIONS FOR PROPORTIONS OF CLASSROOMS IN WHICH MATERIALS WERE OBSERVED IN USE DURING MATHEMATICS

	Mean	Standard Deviation
Puzzles and games	.43	.43
Audio Visual	.11	.26
"Other"	.07	.18

TABLE 3

PROPORTION OF CHILDREN REPORTING "PLAY GAMES" AS A RESPONSE

Mean	Standard Deviation	N
.45	.26	506

TABLE 4

PROPORTION OF TEACHERS ALLOCATING DOLLARS TO MATERIALS OR EQUIPTMENT PURCHASE

	Mean	Standard Deviation	N
Materials	.39	.36	154
Equipment	.15	.25	154

TABLE 5

REGRESSION OUTCOMES: GRADE 2

Reading and Mathematics Achievement

Regressed on Type of Activity During Reading Period

	Reading Achievement			Mathematics Achievement		
	b	Beta	t	b	Beta	t
Puzzles, games	-1.49	-0.18	2.25*	-1.43	-0.16	2.09*
Other	-2.72	-0.17	2.18*			
R^2		.06			.03	

Reading and Mathematics Achievement

Regressed on Type of Activity During Reading and Mathematics Period

	Reading Achievement		
	b	Beta	t
Audio-visual	-2.18	-0.16	2.04*
R^2		.03	

* Significant beyond the .05 level.

TABLE 6

REGRESSION COEFFICIENTS: GRADE 3

Oral Reading Regressed on Type of Activity During Reading Period

	Oral Reading		
	b	Beta	t
Puzzles, games	-54.41	-0.18	1.89
R^2		.03	

Reading Achievement and Oral Reading

Regressed on Type of Activity During Reading and Mathematics Period

	Reading Achievement			Mathematics Achievement		
	b	Beta	t	b	Beta	t
Audio-visual	-1.58	-0.13	1.61	-117.27	-0.24	2.59*
R^2		.02			.06	

*Significant beyond the .05 level.

TABLE 7

REGRESSION ANALYSIS: TEACHERS' REPORTED VARIETY OF MATERIALS

	Attitude			Grade 2 Mathematics Achievement			Grade 3 Mathematics Achievement			Grade 3 Reading Achievement		
	b	Beta	t	b	Beta	t	b	Beta	t	b	Beta	t
Variety of Materials Available in Reading	0.56	.17	1.72	1.36	.26	2.32*	1.36	.29	2.46*	0.90	.20	1.66
R^2		.03			.07			.09			.04	

* Significant beyond the .05 level.

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